

CLAIMS:

1. A lens actuator assembly for an optical head comprising:
 - a lens system comprising a first lens arrangement and a second lens arrangement for focusing a beam of radiation in a focusing direction;
 - 5 a first electromagnetic actuator for actuating at least said first lens arrangement in a focusing direction;
 - a second electromagnetic actuator for actuating at least said second lens arrangement in a focusing direction;
 - wherein at least a part of said first electromagnetic actuator is located at
 - 10 the same axial position as at least a part of said second electromagnetic actuator along the direction of the optical axis of the lens actuator assembly.
2. A lens actuator assembly according to claim 1, wherein said first actuator
- 15 comprises a pair of first coils one each mounted to opposed ends of a housing, said housing accommodating said first lens at an aperture thereof aligned in said focusing direction.
3. A lens actuator assembly according to claim 2, wherein said first actuator comprises a first magnet arrangement comprising a first plate magnet mounted to
- 20 a base in opposed relationship to one said first coil and a second plate magnet mounted to said base in opposed relationship to the other said first coil.
4. A lens actuator assembly according to claim 3, wherein said housing is elastically mounted to said base such as to enable said housing to move in at least said focusing direction while maintaining alignment between said first coils and
- 25 said first and second plate magnets.
5. A lens actuator assembly according to claim 4, wherein said housing is mounted to said base via a plurality of resilient members connected at one end thereof to said base and at another end thereof to said housing.

6. A lens actuator assembly according to claim 4, wherein said first and second plate magnets each comprise a first pair of bar magnets aligned in series in the focusing direction and arranged such that for each said pair of bar magnets, each bar magnet exposes a different pole with respect to a said first coil that is
5 mounted in opposition thereto.

7. A lens actuator assembly according to claim 6, wherein said first coils are substantially rectangular, each said first coil comprising a pair of coil arms each of which is substantially aligned with a corresponding pole of a said first pair of bar magnets that is mounted in opposition to said first coil.

10 8. A lens actuator assembly according to claim 6, wherein said second lens arrangement is accommodated in a lens holder at an aperture thereof aligned in said focusing direction, wherein said lens holder is elastically mounted to said housing via a suspension system.

9. A lens actuator assembly according to claim 8, wherein said second
15 actuator comprises a second magnet arrangement.

10. A lens actuator assembly according to claim 9, wherein said suspension system is configured to enable said lens holder to move in at least said focusing direction while maintaining alignment between said second coils and said second magnet arrangement.

20 11. A lens actuator assembly according to claim 10, wherein said suspension system is configured to enable said lens holder to move in at least said focusing direction while substantially maintaining alignment between said first lens arrangement and said second arrangement along an optical axis of said lens system.

25 12. A lens actuator assembly according to claim 11, wherein said suspension system comprises first and second mounting elements spaced one from the other along the focusing direction and each extending transverse from the focusing direction, each mounting element being elastically deformable along the focusing direction.

13. A lens actuator assembly according to claim 12, wherein said first mounting element is mounted to said housing, and wherein said second mounting element is mounted to said lens holder.
14. A lens actuator assembly according to claim 13 wherein said first mounting element is connected to said second mounting element via substantially rigid spacing members at the transverse ends of said mounting elements.
15. A lens actuator assembly according to claim 12, wherein said first and second mounting elements each comprise a pair of leaf springs joined to a central mounting ring.
16. A lens actuator assembly according to claim 11, wherein said suspension system comprises a first pair and a second pair of mounting elements spaced one from the other along the focusing direction and each extending transverse from the focusing direction, each mounting element thereof being elastically deformable along the focusing direction.
17. A lens actuator assembly according to claim 16, wherein said first pair of mounting elements is mounted to said housing at opposed inner sides thereof, and wherein said second pair of mounting elements is mounted to said lens holder one each at an upper end and lower end thereof.
18. A lens actuator assembly according to claim 17 wherein said first pair of mounting elements is connected to said second pair of mounting elements via substantially rigid spacing members at the transverse ends of said mounting elements.
19. A lens actuator assembly according to claim 18, wherein each said mounting element said first and second pair of mounting elements comprises a pair of leaf springs joined to a central mounting ring.
20. A lens actuator assembly according to claim 8, wherein said second actuator also comprises said first magnet arrangement.
21. A lens actuator assembly according to claim 9, wherein said second actuator comprises a pair of second coils mounted to opposed ends of said lens holder.

22. A lens actuator assembly according to claim 21, wherein said second magnet arrangement comprises two opposed second pairs of bar magnets, each bar magnet of each pair being aligned in series in the focusing direction and arranged such that for each said second pair of bar magnets, each bar magnet
5 exposes a different pole with respect to a said second coil that is mounted in opposition thereto.

23. A lens actuator assembly according to claim 21, wherein each said second coil is in substantially opposed relationship with respect to one or another of said second pair of bar magnets.

10 24. A lens actuator assembly according to claim 21, wherein said second coils are substantially rectangular, each said second coil comprising a pair of coil arms each of which is substantially aligned with a corresponding pole of a bar magnet of said second pair of bar magnets that is mounted in opposition to said second coil.

15 25. A lens actuator assembly according to claim 9, wherein said first magnet arrangement constitutes said second magnet arrangement.

26. A lens actuator assembly according to claim 9, wherein said first magnet arrangement and said second magnet arrangement are disposed substantially orthogonally one to the other with respect to said optical axis of said assembly.

20 27. A lens actuator assembly according to claim 2, further comprising a third electromagnetic actuator for actuating at least said first lens arrangement in a tracking direction substantially orthogonal to said focusing direction.

28. A lens actuator assembly according to claim 27, wherein said third actuator comprises at least one pair of third coils mounted to said opposed ends
25 of said housing.

29. A lens actuator assembly according to claim 28, wherein an auxiliary magnet arrangement provides a suitable magnetic field to said third actuator, enabling operation of said third actuator when a suitable electric current is provided thereto.

30. A lens actuator assembly according to claim 29, wherein said auxiliary magnet arrangement comprises, for each said third coil, a third pair of bar magnets mounted to said base in opposed relationship to said third coil.

31. A lens actuator assembly according to claim 30, wherein each said third
5 pair of bar magnets is aligned in series in the tracking direction and arranged such that for each said second pair of bar magnets, each bar magnet exposes a different pole with respect to a said third coil that is mounted in opposition thereto.

32. A lens holder assembly according to claim 31, wherein each said third
10 coil is positioned adjacent to a corresponding said first coil at each said end of said housing along said tracking direction.

33. A lens actuator assembly according to claim 32, wherein said third coils are substantially rectangular, each said third coil comprising a pair of coil arms each of which is substantially aligned with a corresponding pole of a said third
15 pair of bar magnets that is mounted in opposition to said third coil.

34. A lens actuator assembly according to claim 1, wherein said second lens is an objective lens and said first lens is an auxiliary lens.

35. A lens actuator assembly according to claim 34, wherein said lens system is adapted for enabling a beam of radiation to be focused at any desired
20 depth within a three-dimensional optical data carrier.

36. A lens actuator assembly according to claim 35, wherein said depth is in the range of about 0 to about 3mm.

37. A lens actuator assembly according to claim 34, wherein said lens system is adapted for enabling a beam of radiation to be focused at any desired
25 depth within a range of depths such as to enable said beam to be focused at a data layer of an information carrier, wherein said information carrier may include any one of a range of different types of information carriers each having at least one data layer at a different depth within said range of depths.

38. A lens actuator assembly according to claim 35, wherein said different types of information carriers include at least one of a CD, a DVD and a BluRay disc.
39. A lens actuator assembly according to claim 34, wherein said first lens
5 arrangement is positioned about 100 microns to about 400microns from the surface of an information carrier that it is intended to read/write information with respect to.
40. A lens actuator assembly according to claim 34, wherein said lens system is adapted for enabling a beam of radiation to be focused at any desired
10 depth within a three-dimensional optical data carrier and for enabling collection of signals from said carrier.
41. A lens actuator assembly according to claim 34, wherein said first lens arrangement comprises a meniscus lens.
42. A lens actuator assembly according to claim 34, wherein said second
15 lens arrangement comprises a biconvex lens.
43. A lens actuator assembly for an optical head comprising:
a lens system comprising a first lens arrangement and a second lens arrangement for focusing a beam of radiation in a focusing direction;
20 a first electromagnetic actuator for actuating at least said first lens arrangement in a focusing direction;
a second electromagnetic actuator for actuating at least said second lens arrangement in a focusing direction;
wherein said first and second actuators comprise a common magnet
25 arrangement providing a suitable magnetic field common to both said actuators, enabling operation of each said actuator when a suitable electric current is provided thereto.
44. A lens actuator assembly for an optical head comprising:

a first lens assembly comprising a first lens arrangement and a first electromagnetic actuator for actuating at least said first lens arrangement in a focusing direction;

5 a second lens assembly comprising a second lens arrangement and a second electromagnetic actuator for actuating at least said second lens arrangement in a focusing direction;

wherein said first lens assembly is at least partially nested within said second lens assembly, and wherein said first lens arrangement and said second lens arrangement are adapted for focusing a beam of radiation in a focusing
10 direction.

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